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Turbulence Kinetic Energy Budgets and Dissipation Rates in Disturbed Stable Boundary Layers

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Numerical simulations of the stable atmospheric boundary layer are challenging due to the wide variety of phenomena which can affect a stable boundary, including density currents, breaking Kelvin-Helmoltz waves, and gravity waves, among others. To improve the simulations required by numerical weather prediction models, several new parameterizations have recently been proposed by Cheng, Canuto, and Howard (2002) and Freedman and Jacobson (2003), among others.

We evaluate turbulent kinetic energy (TKE) budgets, the TKE dissipation rate, and the TKE dissipation length over a range of stability regimes represented by a developing stable boundary layer, intrusions (by a cold front and by a density current) into the stable boundary layer, and post-intrusion restabilization, using data from the MICROFRONTS and CASES-99 field experiments. The observations are compared with standard (Louis, 1979) and more recent parameterizations (Freedman and Jacobson, 2003; Cheng, Canuto, and Howard, 2002).

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